

Reflective Argumentation

Michael H.G. Hoffmann, December 2008

When conflicts and disagreements cannot be resolved because there is no common ground, it might be better to replace the fight for ‘the truth’ by an exchange of arguments whose primary purpose is not to ‘win’ but to stimulate reflection, creativity, and perspective shifts. This is what I call “reflective argumentation” by contrast to three better known approaches to argument which Christoph Lumer distinguished recently according to their “standard function”¹: (a) *rhetorical* argumentation focuses on persuasion;² (b) *consensus* theories of argumentation on reaching consensus, i.e., shared beliefs, in an argumentative discourse³; and (c) *epistemological* theories of argumentation, finally, define the “standard output” of arguments as knowledge or justified belief.⁴ The primary purpose of reflective argumentation, by contrast, is to develop arguments as a means to clarify one’s own thinking—either individually or in groups—and to stimulate change of this thinking, that is learning.

“Argument” is often used in the confrontational sense of the term. This usage, however, distracts from a more productive function of arguments: the function to support understanding, reflection, and cognitive change. When we understand an argument, we understand the reasoning behind someone’s position. Since there are mostly various ways to argue for a position, we can see in someone’s arguments how this person

1 Christoph Lumer, "Introduction: The Epistemological Theory of Argumentation—a Map," *Informal Logic*, 25, 3 (2005): 189-212, at p. 189-190.

2 See Chaïm Perelman and L. Olbrechts-Tyteca, *The New Rhetoric. A Treatise on Argumentation*, Translated by John Wilkinson and Purcell Weaver (Notre Dame, Ind.: University of Notre Dame Press, 1969 <1958>); and C. L. Hamblin, *Fallacies* (London: Methuen 1970).

3 See, for example, Frans H. van Eemeren and Rob Grootendorst, *A Systematic Theory of Argumentation. The Pragma-Dialectical Approach* (Cambridge: Cambridge University Press, 2004).

4 This is the position Lumer himself presents in the “Introduction” of two special issues he edited for *Informal Logic*, 25, 3 (2005) and 26, 1 (2006), and in "The Epistemological Theory of Argument—How and Why?," *Informal Logic*, 25, 3 (2005): 213-43. See also Alvin I. Goldman, "Argumentation and Social Epistemology," *Journal of Philosophy* XCI, 1 (1994): 27-49, his *Knowledge in a Social World* (Oxford: Clarendon Press, 1999), and his "An Epistemological Approach to Argumentation," *Informal Logic*, 23 (2003): 51-63.

frames and structures a problem. Conversely, when we are able to construct an argument, we are able to clarify and structure our own thinking, and to change it if we identify gaps, unjustified assumptions, contradictions, or open questions.

Supporting understanding, reflection, and cognitive change is a function of arguments that did not get much philosophical attention so far—in spite of its significance in many areas of life. Given the standard definition of arguing as ‘providing reasons for a claim,’ we can say that arguing is the essence of scientific activity since providing evidence for a hypothesis and developing justifications for positions is just this: providing reasons for a claim. Understanding the world means being able to formulate arguments why the world is the way it is said it is. Arguments promote understanding when used to represent knowledge, hypotheses, explanations, or objections to claims. Arguments, however, are also crucial in social interaction and public affairs. We use arguments to justify positions regarding matters of fact; norms, values, and principles; and recommendations to act. Thus, arguments are crucial for peaceful interaction in face-to-face communication and deliberation, in policy and decision making, in planning, in conflict management, and in any kind of cooperation. In all these areas, however, the point of arguing should not be reduced to persuading others and finding consensus or knowledge; our concept of arguing should include using the construction and reconstruction of arguments as a means to better understand our own thinking and that of others, and to change it if reflection leads us to acknowledging that change is necessary.

The objective of the following considerations is, first, to clarify the conditions of reflective argumentation in this sense of the term and, second, to discuss the possibilities of argument visualization methods in supporting reflection and cognitive change. As we will see, there are many argument visualization tools on the market—developed mainly to support decision making—that can be used for the purpose I have in mind. However, when it comes to *changing* habits of thinking and *learning* by means of arguments it should be necessary to reflect, first of all, on the *conditions* that argument visualization methods need to fulfill to achieve this goal. If the main purpose of formulating or exchanging arguments is cognitive change and learning, then we need a method of arguing which is based on an analysis of cognitive conditions of learning processes.

Providing such an analysis is the objective of the first two parts of this paper. While

the first part develops an understanding of the cognitive problems we are facing in conflicts—obviously the area where belief change is hardest—the second part will, based on this, determine a set of requirements argument visualization tools should fulfill if their main purpose is stimulating reflection and cognitive change. In the third part, I will evaluate available argument visualization methods with regard to these requirements and talk about their limitations. The fourth part, then, introduces a new method of argument visualization which I call Logical Argument Mapping (LAM). LAM has specifically been designed to support reflective argumentation in the following domains:

- in educational settings to foster the ability to argue
- in science, across scientific disciplines, between science and the public, and in policy and decision making to facilitate communication, collaboration, reflection, and learning on highly complex issues like climate change and climate policies
- in conflict management to support conflict resolution and cross-cultural understanding by visualizing the inferential structure of framing processes that determine how parties to a conflict make sense of what is going on.⁵

The fifth part, finally, provides an example of how Logical Argument Mapping could be used as a method of reflective argumentation in a political controversy.

The main objective of this article is to defend two theses: first, that available argument visualization tools do not challenge users enough to induce cognitive change; and, second, that the potential of Logical Argument Mapping in this regard is based on the fact that it uses—in contrast to all argument visualizations methods I know of—primarily deductively valid argument schemes. To argue for both these points, however, it is necessary to develop first a better understanding of the cognitive problems reflective argumentation faces.

Before I start, let me define some concepts. As indicated already, I am using the term “argument” as a constellation of statements which consists of a claim and at least one statement that is intended as a reason for this claim. The term “argumentation,” by contrast, will be used here as a set of statements in which elements of an argument are

5 See Michael H.G. Hoffmann, "Logical Argument Mapping: A Method for Overcoming Cognitive Problems of Conflict Management," *International Journal of Conflict Management*, 16, 4 (2005): 304-34.

either supported by further reasons or complete arguments, or attacked by objections and arguments. Additionally, I am introducing the concept of “argument revision” to describe the following three processes: (a) refining or changing the constitutive elements of arguments and argumentations; (b) introducing new elements or discarding existing ones; and (c) re-organizing the structure of arguments and argumentations. In Logical Argument Mapping these concepts are further specified by lists of “argument schemes,” “conflict schemes,” and “revision schemes.”⁶ The term “argument visualization,” finally, is used for spatial representations of arguments, argumentations, and argument revisions in which the statements that constitute an argument are spatially separated and connected by arrows or lines.

I. COGNITIVE PROBLEMS OF CONFLICTS

The hardest challenge for cognitive change are obviously those conflicts whose intractability results from conflicting systems of beliefs, values, and attitudes that are deeply rooted in people’s thinking and feeling. How could it be possible, for instance, to “de-radicalize” Islamist militants by means of arguments, as Indonesia’s anti-terrorism police attempted in the aftermath of the Bali bombing in 2002 which killed 202 people?⁷ There are good reasons to be skeptical, as Robert Fogelin showed already two decades ago. Fogelin argued that what he called “deep disagreements”—by contrast to “normal” argumentative exchange—“cannot be resolved through the use of argument, for they undercut the conditions essential to arguing.” The possibility of arguing, he says, presupposes “a shared background of beliefs and preferences,” and if such a background is not given, there is no way of “rational” dispute resolution.⁸ Therefore, only “normal” argumentative exchange is possible for Fogelin, where “normal” means: “within a context of *broadly* shared beliefs and preferences.” If I ask Fogelin why he takes a certain route for his shopping and he responds, “I want to pick up the fish last,” there is no need

6 See <http://www.prism.gatech.edu/~mh327/LAM/>.

7 See “Reforming Jihadists. Preachers to Be Converted,” *Economist*, 385, 8559 (Dec. 15, 2007): 71-72.

8 Robert Fogelin, “The Logic of Deep Disagreements,” *Informal Logic*, 7 (1985): 1-8, pp. 5, 7.

for further reasons. Within our “shared background of beliefs and preferences” it is clear that we prefer fresh over stinking fish.

Fogelin mentions disputes over the morality of abortion, or affirmative action quota, to make his point that it is *impossible* to resolve deep disagreements by means of arguments. The crucial feature in those cases is that the source of disagreement are not simply “isolated propositions (‘The fetus is a person.’), but instead a whole system of mutually supporting propositions (and paradigms, models, styles of acting and thinking).” Similarly, Allen Buchanan showed in his analysis of what he called “selective cognitive disabilities” that false beliefs like racist or sexist prejudices “are typically elements of a web of mutually supporting false beliefs.”⁹ Those “webs” of beliefs are resistant to change because they can easily be defended against any sort of evidence to the contrary by *ad hoc* hypotheses. Referring to his own childhood in the racist American South, he tells the story how people who believed “in the mental inferiority of blacks” systematically excluded obvious counter examples simply by appealing “to another strand in their complex web of racist beliefs: the notion that the presence of some ‘white blood’ in a black person could raise him above the low position of blacks generally.”¹⁰ Any core belief can be saved by *ad hoc* hypotheses. By contrast to Fogelin, however, Buchanan thinks that it is possible to change things. But this “will typically require more than just providing good evidence that a particular belief is false. Instead, the process will require attacking a large set of mutually supporting beliefs,” that is as a whole.¹¹

Those “webs” of mutually supporting beliefs are not only relevant when people argue, but also—on a deeper level—for those cognitive processes which determine how we perceive and interpret the world around us. In conflict research it has long been observed that a crucial obstacle for the resolution of conflicts is often that stakeholders “frame” in radically different ways what their conflict is about, its history, central events and data, their own role in it, that of their opponents and third parties, and how it might be resolved.¹² Elsewhere, I proposed to use the term “sensemaking” to distinguish more

9 Allen Buchanan, "Social Moral Epistemology," *Social Philosophy & Policy*, 19, 2 (Sum, 2002): 126-52, at p. 140.

10 Ibid., pp. 139-140.

11 Buchanan, "Social Moral Epistemology," p. 140.

12 See for example Barbara Gray, "Mediation as Framing and Framing within Mediation," in Margaret

clearly the cognitive dimension of framing from its expressive side which becomes visible, on the one hand, in how parties to a conflict set the boundaries around an issue and construct meanings on the other.¹³ Sensemaking can be defined as the process of interpreting data in a way that they fit into a belief-value-attitude system, where “data” can be externally observable signs, people, things, events, etc., but also ideas or thoughts; and a “belief-value-attitude system” is a web of beliefs, values, and attitudes that is more or less consistent from its bearer’s point of view. The “fit” of data into a belief-value-attitude system can be achieved either by constraining the data (neglecting what is incomprehensible, or interpreting it in a way that it fits); by changing the system; or by a mixture of both. When I am talking about “cognitive change,” I mean any change within a belief-value-attitude system.

Some of the most important difficulties we face in conflict management can be explained by the observation that belief-value-attitude systems are hard to change. Especially in cases where the individual or social identity of stakeholders is intrinsically tied to a certain belief-value-attitude system, trying to change the system becomes easily experienced as an existential threat. Social psychologist Dan Bar-Tal coined the term “sociopsychological infrastructure” to describe the fundamental role of what I call belief-value-attitude systems in intractable conflicts.¹⁴ It is essential for parties to intractable conflicts to develop such a “sociopsychological infrastructure” in order to cope with stress and fear; to satisfy psychological needs like “knowing, mastery, safety, positive identity”; and to “develop a system of psychological conditions such as loyalty to a society and country, high motivation to contribute, persistence, readiness for personal sacrifice, unity, solidarity” that is necessary to withstand the rival group.¹⁵ This sociopsychological

S. Herrman, *The Blackwell Handbook of Mediation: Bridging Theory, Research, and Practice* (Malden, MA; Oxford, U.K.; Carlton, AU: Blackwell, 2006), pp. 193-216, and Deborah Shmueli, Michael Elliott, and Sanda Kaufman, "Frame Changes and the Management of Intractable Conflicts," *Conflict Resolution Quarterly*, 24, 2 (2006): 207-18.

13 See Michael H.G. Hoffmann, "Analyzing Framing Processes by Means of Logical Argument Mapping," *Intl. Association for Conflict Management, IACM 20TH Annual Conference Paper*, Available at SSRN: <http://ssrn.com/abstract=1298520> (2008).

14 Daniel Bar-Tal, "Sociopsychological Foundations of Intractable Conflicts," *American Behavioral Scientist*, 50 (2007): 1430-53, at p. 1434.

15 Ibid.

logical infrastructure reinforces itself permanently through collective memories, through narratives that form a “*configuration of shared central beliefs that provide a particular dominant orientation to a society at present and for the future*,” and through the “collective emotional orientation of a society.”¹⁶ This infrastructure “serves as a prism through which the society members collect information and interpret new experiences”¹⁷—information and experiences that again confirm the narratives and emotions that constituted the sociopsychological infrastructure in the first place, contributing thus to perpetuating conflicts that are called “intractable” just because of those mechanisms of seemingly eternal reinforcement.

However, changing belief-value-attitude systems is not only hard in intractable conflicts. If we define—following Charles Peirce—“beliefs” as “habits,” it is clear that beliefs will not be easier to change than habits. “We *believe* the proposition we are ready to act upon,” wrote Peirce.¹⁸ This suggests that we change our beliefs only in situations where it turns out that our “intellectual habits” are insufficient to cope with problems. When our beliefs are *disrupted* by doubts induced by new experiences, creativity is necessary to change and develop our belief-habits. As long as they “work,” however, no change is necessary. Isaac Levi called this the principle of “doxastic inertia” in Peirce’s pragmatism.¹⁹

By contrast to Buchanan who only talks about webs of mutually supporting *false* beliefs, and to conflict researchers who use the term “framing” only to describe *partisan* behavior, I would argue that belief-value-attitude systems are basic for all perception (or interpretation). The point of this argument is the same that Norwood Hanson made when he argued for theory-ladenness of observation, or Duhem and Quine in their arguments for the holistic character of scientific knowledge. But more significant—for my purposes—is the form Helen Longino gave this argument. Since “states of affairs”

16 Ibid., pp. 1435-1440 (his italics).

17 Ibid., p. 1436.

18 *Collected Papers of Charles Sanders Peirce: Volumes I-VI*, Ed. By Charles Hartshorne and Paul Weiss, 1931–1935, *Volumes VII-VIII*, Ed. By Arthur W. Burks, 1958 (Cambridge, Mass.: Harvard UP), 1.635 (quoted according to volume and paragraph). See also CP 2.148, 2.435.

19 Isaac Levi, “Pragmatism and Change of View,” in Cheryl Misak, *Pragmatism* (Calgary, Alberta: Univ. of Calgary Press, 1999), pp. 177-201.

which someone might use as evidence for a hypothesis do not “carry labels indicating that for which they are evidence or for which they can be taken as evidence,” it is clear, she writes, that any assumption of an evidential relation “depends on one’s other beliefs, which we can call background beliefs or assumptions.”²⁰ Instead of a dyadic relation between hypothesis and evidence, we should assume thus a triadic relation with “background assumptions” as the third, mediating element.

Such a triadic epistemology implies that a critical analysis of the way we justify knowledge claims by reference to evidence would lead to an infinite network of mutually supporting assumptions because any background assumption is again based on further evidential relations and background assumptions, and so on. Science would simply be impossible if we demand that authors of scientific publications reveal the ‘complete’ network of mutually supporting background assumptions necessary for ‘justification’ in a perfect sense of the word. Instead, we take most of those background assumptions simply for granted, that is we don’t subject them “to empirical confirmation or disconfirmation.”²¹ This, however, is nothing else than saying that assuming an evidential relation is partly based on habits. As long as our background assumptions remain implicit when we provide a certain state of affairs as evidence for a certain hypothesis, the process of providing evidence is habit-driven.

Since it is hard to see how the relation between evidence and hypothesis that Longino describes can be any different from what happens in sensemaking between “data” and the “perception” or “interpretation” they produce in cognition, it should be legitimate to assume that we are facing exactly the same triadic relation in sensemaking processes. Whatever we call a perception of data is not only based on this data, but also on those background assumptions that are already part of our respective belief-value-attitude systems. This, however, means that attempting to reconstruct sensemaking processes completely would lead to the same infinity of background assumptions that are supported by evidence and further background assumptions, and so on, that we noted already as an implication of Longino’s approach. Although it is clear that this infinity is usually not a problem since, most of the time, we don’t have any reasons to doubt the evidential rela-

²⁰ Helen E. Longino, *Science as Social Knowledge. Values and Objectivity in Scientific Inquiry* (Princeton, N.J.: Princeton University Press, 1990), at pp. 40, 43.

²¹ Ibid., p. 75.

tions and background assumptions that form the backbone of sensemaking processes, it should be clear as well that we are using cognitive shortcuts in these cases; habit-driven shortcuts that—although crucial for survival under time pressure—demonstrate that what we call knowledge and understanding is always and necessarily limited. Based on these principal limits of justification, we can conclude that the human mind is never able ‘to know the whole.’

If we accept the thesis that any sensemaking process is necessarily limited, selective, and partly driven by habits, we should also accept two implications of this assumption. First, Fogelin’s distinction between “normal” argumentative exchange that is based on “a shared background of beliefs and preferences” on the one hand, and “deep disagreements” on the other, loses some of its significance when it is simply not clear which beliefs and preferences are shared and which are not. If we do not even know the complete structure of our own background assumptions, it should be better—in order to keep at least the possibility of mutual understanding open—to assume some common ground than giving up any hope of finding it from the start.

On the other hand, if any sensemaking is inevitably limited, it is clear that this is true also for the scientific analysis of those sensemaking processes. There is no “frame-neutrality,” as Schön and Rein put it in their book on framing,²² no view from nowhere. There is no ‘objective’ description of conflicts. That means, the possibilities of objective knowledge and justifying claims as being true are also limited.

To summarize, a method of argument visualization that focuses on reflection and cognitive change has to address at least three problems: First, since beliefs are always embedded in “webs” of mutually supporting beliefs (Buchanan), we have to think about strategies of how to get access—as far as possible—to entire webs of beliefs, not only to singular statements. Second, since the analysis of any argument can lead—step by step—to a revelation of networks of mutually supporting beliefs, it should be possible to take any reason someone provides for a claim to start this process. And third, as we learned both from Peirce’s identification of belief and habit and Bar-Tal’s observations about the identity-constituting function of sociopsychological infrastructures, the main

22 Donald A. Schön and Martin Rein, *Frame Reflection. Toward the Resolution of Intractable Policy Controversies* (New York: BasicBooks, 1994), at p. 36.

difficulty in changing people's thinking results obviously from the fact that, first, important background assumptions remain often implicit and unconscious and, second, that challenges to change belief systems are sometimes experienced as existential threat.

II. REQUIREMENTS FOR REFLECTIVE ARGUMENT VISUALIZATION METHODS

We can use now this list of three problems to distinguish the following requirements argument visualization methods should fulfill if their primary purpose is reflection and cognitive change.

- R1. In order to address webs of mutually supporting beliefs, a method of argument visualization should be able to represent—at least in principle—everything that is relevant to understanding someone's sensemaking processes, not only the reasons this person is ready to provide for his or her claims.
- R2. Such a method should allow us to visualize and explore webs of beliefs in an ongoing process, so that it can guide the user step by step in visualizing those structures.
- R3. In order to overcome resistance against cognitive change, methods of argument visualization must be challenging and powerful.

The last point, of course, immediately raises the question of how this could be achieved. From my point of view, the best answer to this question has been formulated by Charles Peirce in what he developed as “diagrammatic reasoning.”²³ Peirce's central idea was, as Kathleen Hull summarized, that, by externalizing our reasoning in diagrams, we create

23 See Frederik Stjernfelt, *Diagrammatology: An Investigation on the Borderlines of Phenomenology, Ontology, and Semiotics: Synthese Library 336* (Dordrecht, NL: Springer, 2007); Michael H.G. Hoffmann, "How to Get It. Diagrammatic Reasoning as a Tool of Knowledge Development and Its Pragmatic Dimension," *Foundations of Science*, 9, 3 (2004): 285-305; and "Seeing Problems, Seeing Solutions. Abduction and Diagrammatic Reasoning in a Theory of Scientific Discovery," in Olga Pombo and Alexander Gerner, *Abduction and the Process of Scientific Discovery* (Lisboa: CFCUL/Publidisa, 2007), pp. 213-36.

“something (non-ego) that stands up against our consciousness. ... reasoning unfolds when we inhibit the active side of our consciousness and allow things to act on us.”²⁴ The question is, however, how that could be possible, given the ‘natural’ reluctance to change belief-habits described above.

The crucial point of changing people’s mind by diagrammatic reasoning—or by argument visualization as a specific form of diagrammatic reasoning—is the fact, I would argue, that diagrams—according to Peirce’s definition—are constructed by means of “a perfectly consistent system of representation.”²⁵ Such a representational system can be defined by three elements: (a) an ontology that defines the types of entities and relations that can be represented by means of the system; (b) rules according to which diagrams can be constructed and experiments performed; and (c) conventions which facilitate the process of diagrammatic reasoning. Since Peirce developed the concept of diagrammatic reasoning in order to explain the possibility of creativity in mathematics,²⁶ the best example of a “system of representation” might be an axiomatic system. A system of axioms does not only define the representational means that are available in the field axiomatized, but it determines also the necessary outcome of any operation or experimentation we perform within such a system.

It is crucial for the possibility of learning by diagrammatic reasoning that one has to be familiar with a chosen system of representation. This can best be described by an example. Let’s take the oldest description of diagrammatic reasoning I know of, namely the story Plato tells in his *Meno* about the ‘learning’ process that an uneducated slave boy experiences under the guidance of Socrates. Socrates makes sure that the boy knows what a square is by drawing a figure like ABCD in Figure 1 in the sand (including something like the dotted lines) and asking him some questions about it. The side AB of this square is supposed to be two feet, and it turns out that the boy knows that the size of the square is thus four square feet, and that a square double the size of

24 Kathleen Hull, "Why Hanker after Logic? Mathematical Imagination, Creativity and Perception in Peirce's Systematic Philosophy," *Transactions of the Charles S. Peirce Society*, 30 (1994): 271–95, pp.282, 287. See also Peirce, *Collected Papers*, 1.324.

25 See Peirce’s definition in *Collected Papers*, 4.418. For this argument, see also my papers that are listed in Footnote 23.

26 *Collected Papers*, 3.363 and 3.559-560.

ABCD would be eight square feet.²⁷ After an agreement is reached about this, Socrates asks the boy how long the *side* of the eight square feet square would be.

The boy's first suggestion is that the side should be "twice the length" of the original square side, that is four feet long. Obviously, he simply correlates doubling the area to doubling the side. But what does Socrates do to show that this answer is inadequate? He experiments with the diagram of the square he just drew and demonstrates the necessary implications of the boy's suggestion at the concrete figure. This operation results in the square AGFE (Figure 1). Looking at this big square, the boy must admit that his answer yields a square that is four times the size, not twice, of the original square.²⁸

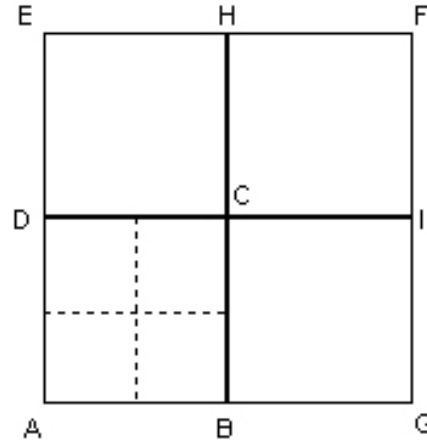


Figure 1: What is the length of the side of a square whose size is double the size of ABCD?

At this point in the story, Plato highlights the importance of the disappointment the boy experiences regarding his expectations. Since he is able to acknowledge his ignorance regarding the matter, he is now "in a better position." In this new situation "he would be glad" to find out the right answer, "whereas before he thought he could easily make many fine speeches to large audiences about the square of double size and said that it must have a base twice as long."²⁹ Seeing the necessary implications of his premature assumption motivates the boy to search for the correct solution. Socrates' experiment with the diagram is a way to produce this motivation.

However, what is it in this process of experimenting with the diagram that forces the boy to give up his first hypothesis? Although it might sound trivial from an educated point of view, it is crucial to note that the boy's insight in his failure is only possible if the following cognitive conditions are fulfilled. He has to accept, first, that doubling the side of ABCD leads necessarily to AGFE; second, that there is a contradiction between

²⁷ Plato, *Meno*, 82c,d (Stephanus pagination).

²⁸ Ibid., 82e-83b.

²⁹ Ibid., 84b,c.

this result and his expectation; and, third, that contradictions are not acceptable, they have to be resolved.

The first of these conditions depends obviously on what is essential for diagrammatic reasoning: the consistency and rationality of the representation system we choose to construct a diagram. As noted above, the outcome of any experiment we perform with a diagram is determined by the rules of the chosen representational system. Observing the experiment with the original square, nobody would doubt that doubling the side of ABCD leads to AGFE, but accepting this as true is grounded in two very different things: on the one hand in the objective truth that a consistent system of representation like Euclidean geometry determines necessarily the outcome of the observable operation on the diagram and, on the other, in the subjective precondition that we are able to accept this objective truth. It is essential that, on the one hand, the representation systems we choose to construct a diagram are, first of all, cultural tools whose validity, usefulness, or appropriateness is socially established so that individuals cannot change it by their own choice and, on the other, that the outcome of any experiment with such a diagram is necessary and true for us.

Based on this, we can say the boy's first step of learning by means of diagrammatic reasoning depends on the following conditions. He has to

- a) know the rules and conventions of the chosen representational system that determine the construction of a diagram and the outcome of experiments with it (at least so far as they are relevant for a concrete problem);
- b) accept these rules and conventions;
- c) accept the principle of non-contradiction;
- d) feel forced to avoid contradictions, and to be motivated to look for a resolution of contradictions.

The general conclusion I would draw from this example is that a learning experience that is induced by diagrammatic reasoning is the more compelling the clearer the rules and conventions of the chosen representational system are in themselves, and the more distinctly they are known by a learner. We can use a tool effectively only if we know

how it works. In this sense, systems of representation are normative systems.

It is exactly this normativity of representational systems that makes it possible, I think, to get the challenging power we need to overcome the resistance against cognitive change that I mentioned above in my third requirement for methods of argument visualization. Thus, this third requirement could be refined as follows, which leads us again to some more requirements:

- R3* In order to overcome resistance against cognitive change, methods of argument visualization should be based on a system of representation whose rules and conventions are as clearly defined as possible.
- R4. The rules of these representation systems must be acceptable for users independently from their stance in a controversy, and they should be as obvious as possible (controversy should be about the content of arguments, not on how to apply the rules of a representational system).
- R5. A method of argument visualization that is supposed to facilitate reflection and cognitive change must provide everything a user needs to evaluate the process of argument visualization he or she performs.

This last point might be the most important of all. As everyone can confirm who teaches undergraduates introductory logic or critical thinking, knowledge and a lot of practice is needed to evaluate the quality of an argument. If students don't get familiar with a clear, normative standard with reference to which they can assess what they are doing when they transform an argument from its textual formulation into a symbolic or graphic form, the outcome will often be unacceptable for an expert. The failure to provide such a clear standard of argument evaluation seems to be the biggest problem of Toulmin's famous model of argument (see Figure 2).³⁰ As Ralph Johnson showed in a "critical review and appreciation of *An Introduction to Reasoning* by Stephen Toulmin, Richard Rieke, and Allan Janik," these authors themselves are using the Toulmin-model in ways that are highly questionable. Johnson blames especially Toulmin's "warrant" for the many prob-

30 Stephen Toulmin, *The Uses of Argument* (Cambridge, U.K.; New York: Cambridge University Press, 2003 <1958>, updated ed.).

lems he finds in the examples of this textbook. “Toulmin’s explanation of the concept of a warrant is loose rather than tight,”³¹ and it is defined in so many different ways that it is hardly surprising that users take it as they want.

The crucial point is that there is not much of a need to reflect critically on one’s thinking if there are only weak constraints on how to visualize an argument. If nearly everything is possible, it is difficult to evaluate the quality of what one is doing when constructing arguments. An evaluation can only be justified if there is a clear normative standard. This allows us to reformulate the requirement R5 as follows:

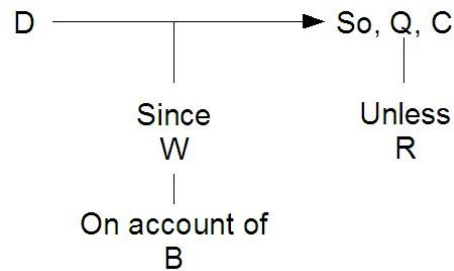


Figure 2: The famous “Toulmin model,” from *The Uses of Argument*, p. 97. “D” means data, “W” warrant, “B” backing, “Q” qualifier, “C” claim, and “R” rebuttal.

R5* A method of argument visualization that is supposed to facilitate reflection and cognitive change must provide a clear normative standard to evaluate the process of argument visualization. Such clarity depends on two conditions: first, there must be a finite list of elements that constitute the standard and, second, these elements must be as clearly defined as possible, avoiding any ambivalence.

III. LIMITATIONS OF AVAILABLE ARGUMENT VISUALIZATION METHODS

The question is now, of course, how a concrete and usable model of argumentation could be designed that indeed fulfills the five requirements listed above. If we take a look at what is on the market so far, we can identify some limitations of available argument visualization tools. Toulmin’s model of argument—besides the problems mentioned above—offers only six elements that constitute an argument (see Figure 2

31 Ralph H. Johnson, *The Rise of Informal Logic* (Newport News, VA: Vale Press, 1996), p. 134; see also James B. Freeman, “Systematizing Toulmin’s Warrants: An Epistemic Approach,” *Argumentation*, 19, 3 (2005): 331-46.

above). That means, this model does not invite the user to explore entire “webs” of mutually supporting beliefs, values, and attitudes in a dynamic way (as demanded by requirements R1 and R2). Quite the contrary: It has been shown that this fixed pattern of argument often leads users “to squeeze everything into a single simple diagram”³² so that results are more confusing than enlightening.

More interesting with regard to detailed analyses of very complex issues are Robert Horn’s “argumentation maps.” These maps structure great historical debates like “Can Computers Think?” based on an analysis of hundreds of publications.³³ However, they do not visualize singular “arguments” in the sense defined above, but only the relations among arguments (“is supported by” / “is disputed by”) which for themselves are summarized in normal text descriptions. However, it would be interesting to combine his focus on representing the macro-structure of debates with a micro-analysis of singular arguments whose main purpose should be to reveal how people frame an issue, which background assumptions are relevant that are not expressed in the original formulation, and whether there are weak points and contradictions.

While Horn focuses on representing a detailed picture of debates that developed over decades by abstracting from the micro-structure of arguments, visualization methods that are based on Rittel’s “Issue Based Information System” (IBIS) like Jeff Conklin’s *Dialogue Mapping*³⁴ and similar software tools³⁵ often concentrate on processes that take place before precise arguments are formulated. The main goal is here—as with “mind mapping” software—to cope with complexity. Available tools can either be used by individuals to clarify complex issues or by facilitators of group communication; in real time, the facilitator would put on a screen what people say in debates, thus chal-

32 Des R. Gasper and R. V. George, "Analyzing Argumentation in Planning and Public Policy: Assessing, Improving, and Transcending the Toulmin Model," *Environment and Planning B-Planning & Design*, 25, 3 (May, 1998): 367-90, at p. 367.

33 See Robert E. Horn, Jeffrey Yoshimi, Mark Deering, and Russell McBride, *Mapping Great Debates: Can Computers Think? (Map)* (Bainbridge Island, WA: MacroVu Pr, 1998; also available via <http://www.macrovu.com/>).

34 Jeffrey Conklin, *Dialogue Mapping: Building Shared Understanding of Wicked Problems* (Chichester, England; Hoboken, NJ: John Wiley & Sons, 2006).

35 See for example Tim van Gelder’s “ReasonAble,” “Rationale,” and “bCisive” (www.austhink.com) and Simon Buckingham Shum’s “Compendium” and “Cohere” (<http://kmi.open.ac.uk/>).

lenging participants to reflect on questions like what the main points of a debate are and how to structure the discussion by distinguishing pro and contra considerations, reasons and objections, but also ideas and questions. Although “arguments” in the sense defined here may be an important part of these visualization approaches, the primary objective is to *clarify* issues. Conklin’s main intention is to help groups to cope with problems of social complexity and “wicked problems” in meetings, and for others the goal is “keeping track of a plethora of ideas, issues, and conceptual interrelationships.”³⁶ The process of “argument” visualization includes here activities like problem solving; the generation of hypotheses and evaluation criteria; expressing doubt and disbelief; reifying, contrasting, criticizing, and integrating perspectives. However, though all this goes well beyond “providing reasons for a claim,” many of these approaches have been proven successful with regard to stimulating reflection and managing controversies in which “arguments seemed to just go around in circles, and disagreement seemed only to become more entrenched.”³⁷ A limitation, however, of these approaches can be seen in the fact the representational systems used are often not clearly enough defined (R3*; R5*). Instead of enforcing a normative standard of argument analysis, construction, and evaluation, nearly everything is possible. Everything can be put on a screen—or not be put on a screen—without really challenging the user to change basic assumptions and webs of beliefs, because those assumptions and webs can remain hidden forever.

Much more precise with regard to defining the rules, conventions, and ontologies of argument visualization systems are those models that are presently developed in computer science. The main goal here is to provide realistic models of concrete arguments.³⁸

36 See Albert M. Selvin, "Fostering Collective Intelligence: Helping Groups Use Visualized Argumentation," in Paul A. Kirschner, Simon J. Buckingham Shum and Chad S. Carr, *Visualizing Argumentation: Software Tools for Collaborative and Educational Sense-Making* (London: Springer, 2003), pp. 137-63, at p. 138.

37 Tim J. van Gelder, "Enhancing Deliberation through Computer-Supported Argument Visualization," in Paul A. Kirschner, Simon J. Buckingham Shum and Chad S. Carr, *Visualizing Argumentation: Software Tools for Collaborative and Educational Sense-Making* (London: Springer, 2003), pp. 97-115, at p. 108.

38 See, for instance, Phan Minh Dung in his seminal paper "On the Acceptability of Arguments and Its Fundamental Role in Nonmonotonic Reasoning, Logic Programming and N-Person Games," *Artificial Intelligence*, 77, 2 (Sep, 1995): 321-57, p. 321: "The purpose of this paper is to study the funda-

Objectives are things like (a) modeling how the burden of proof shifts in argumentative discourse;³⁹ (b) designing models that support and visualize argumentations in legal settings⁴⁰ and in the context of deliberative democracy;⁴¹ and (c) defining an “Argument Interchange Format” (AIF) that is rich enough so that data and structures of all available argument models can be represented in one, comprehensive model.⁴²

As far as I can see, there are three major problems with computational models of argument: The first one is that they are either still in development or cover only parts of a visualization method that could fulfill all the requirements listed above. The second is that what is developed so far is much too complicated to be ‘user friendly;’ this, of course, is not surprising given the fact that the primary goal is to implement argumentative procedures in software, not to provide tools that could be used by, let’s say, high school students. The third problem is more serious: Since the final goal is to model realistically how people argue, the development of software proceeds basically ‘inductively.’ While everything has to be designed in a way that it can be computed, implying that the formulation of general rules describing argument moves is crucial, the human practice of “arguing” is obviously so broad and ill-defined that it is hard to see how a final system of argument rules could be simple enough to be used as a normative standard. While the Toulmin model turned out to be too limited in its expressive power, these computational models offer such a huge variety of “argument schemes,”⁴³ “conflict schemes,” “prefer-

mental mechanism humans use in argumentation, and to explore ways to implement this mechanism on computers.”

39 See Thomas F. Gordon, Henry Prakken, and Douglas Walton, "The Carneades Model of Argument and Burden of Proof," *Artificial Intelligence*, 171, 10-15 (2007): 875-96.

40 A useful overview is provided by Chris Reed, Douglas Walton, and Fabrizio Macagno, "Argument Diagramming in Logic, Law and Artificial Intelligence," *The Knowledge Engineering Review*, 22, 1 (2007): 87-109.

41 Katie Atkinson, Trevor Bench-Capon, and Peter McBurney, "Parmenides: Facilitating Deliberation in Democracies," *Artificial Intelligence and Law*, 14, 4 (2006): 261-75.

42 See C. Chesnevar, J. McGinnis, S. Modgil, I. Rahwan, C. Reed, G. Simari, M. South, G. Vreeswijk, and S. Willmott, "Towards an Argument Interchange Format," *Knowledge Engineering Review*, 21, 4 (December, 2006): 293-316.

43 See for various lists Douglas Walton, *Argumentation Schemes for Presumptive Reasoning: Studies in Argumentation Theory* (Mahwah, NJ: Lawrence Erlbaum, 1995); John L. Pollock, *Cognitive*

ence schemes,” and so on, that they tend to be too complex. The underlying rules are neither obvious enough to challenge a user to reflect critically on implicit assumptions (R4), nor do they provide a simple and clear standard of argument construction that a user could apply to evaluate the quality of his or her arguments (R5*).

As I showed with regard to Peirce’s concept of diagrammatic reasoning, we can use tools effectively only if we know how they work. The less we think about a tool, the more we can focus on what we want to achieve with it. If the grammar of a visualization ‘language’ is too complicated, it will be hard to meet the five requirements I distinguished in the previous section.

IV. LOGICAL ARGUMENT MAPPING (LAM)

Logical Argument Mapping, the method I want to propose in this section as a tool to stimulate reflection and cognitive change, has been designed to fulfill these five requirements. The main strategy to achieve this goal is a system of representation that imposes—by contrast to all the other argument visualization methods I discussed so far—the standard of deductive validity on the construction of the central parts of an argumentation. This design decision is most clearly expressed in the three rules that determine the normative standard of Logical Argument Mapping:

1. Represent your main argument—and every sub-argument that might be controversial—according to an argument scheme whose deductive validity is evident or can be made plausible.⁴⁴

Carpentry. A Blueprint for How to Build a Person (Cambridge, Mass.: MIT Press, 1995); and Joel Katzav and Chris A. Reed, "On Argumentation Schemes and the Natural Classification of Arguments," *Argumentation*, 18, 2 (2004): 239-59.

⁴⁴ It is still an open question how to define exactly the list of logically valid argument schemes available in LAM, but the following seems to be a good starting point for a list that is, on the one hand, comprehensive enough for the most frequent applications and, on the other, limited enough to achieve the clarity needed for cognitive change: *modus ponens*, *modus tollens*, disjunctive syllogism, XOR syllogism (while the XOR syllogism is based on an “exclusive or” in “either – or,” the disjunctive syllogism uses an “inclusive or,” that is both sides of “either – or” can be true), not-both syllogism (based on “NAND” for “not and”), conditional syllogism, constructive dilemma, equivalence;

2. Consider the acceptability of all your premises, and provide further arguments for those whose acceptability is either not evident or controversial.
3. Make sure that all your premises are consistent with each other.

Given the development of “argumentation theory,” “informal logic,” and “critical thinking” over the last fifty years, the focus on deductive argument schemes might sound like a backwards revolution. When Stephen Toulmin revolutionized thinking on argumentation in *The Uses of Argument*, he started by criticizing traditional logic as being out of touch with any practical application. Since Descartes, he says, logic became a more and more specialized, philosophical discipline “in isolation from all practical contexts.”⁴⁵ Logic became a “theoretical study on its own, as free from all practical concerns as is some branch of pure mathematics.”⁴⁶ Based on this observation, he saw the need “to *redress the balance* between formal logic and rhetoric, theory and practice, or the ‘analytical’ and ‘non-analytical’ aspects of human reasoning.”⁴⁷ However, the fact that logic can be studied and developed as a ‘pure’ scientific discipline like any other can hardly be an argument against an approach that *uses* some basic logical inferences for practical purposes.

More serious objections against so-called “deductivism” in argumentation theory have been formulated by the “informal logic” movement.⁴⁸ However, the term “deductivism” has been used here, as far as I can see, in three different ways. A short discussion of these should help to better understand the role of deductive argument schemes in

complete induction, argument from perfect authority, and argument from perfect analogy (more on the last three in a moment), and the fifteen valid forms of deduction in categorical logic.

45 "Logic, Rhetoric & Reason: Redressing the Balance," in F.H. van Eemeren, R. Grootendorst, J.A. Blair and C.A. Williard, *Argumentation Illuminated: Selected Papers from the 1990 International Conference on Argumentation* (Dordrecht: Foris, 1992), pp. 3-11, at pp. 3-5.

46 Toulmin, *The Uses of Argument*, p. 2 and 88.

47 "Logic, Rhetoric & Reason," p. 5.

48 For a comprehensive discussion of these objections see Ralph H. Johnson, *Manifest Rationality: A Pragmatic Theory of Argument* (Mahwah, N.J.: Lawrence Erlbaum Associates, 2000), p. 57-107. It is important to note, however, that Johnson discusses “deductivism” as a *theory* of argumentation. This is not what I have in mind when using deductive argument schemes in LAM. LAM is a method, not a theory.

Logical Argument Mapping. A first useful distinction has been provided by David Godden: “deductivism can be formulated as an evaluative and as a reconstructive (or interpretive) thesis.”⁴⁹ He tracks both these theses back to quotes from Leo Groarke, and defines the “evaluative” view of deductivism by the thesis that “all good arguments are deductively valid,”⁵⁰ and the “reconstructive” view as the thesis that “natural language arguments should be understood as attempts to formulate deductive arguments.”⁵¹ A third form of “deductivism” has been suggested by Ralph Johnson when he defines the term as “the view that reasoning is inherently deductive in character.”⁵²

It is important to note that only the second of these definitions—if interpreted in a certain way—comes close to the deductive character of Logical Argument Mapping. Regarding the third one, the point is that the empirical question of how humans reason does not have any relevance for LAM since the method does not intend to *represent* reasoning, but to stimulate it. LAM is not based on a *descriptive* thesis, but on a *strategic*, or *heuristic*, thesis; the thesis, namely, that it is *useful*—with the regard to the goals of reflective argumentation—to challenge people to reconstruct their thinking in the form of deductively valid arguments. Even if we assume that human reasoning proceeds arbitrarily, irrationally, or driven by all kinds of non-deductive mechanisms, we can still propose the thesis that representing reasoning *in the form* of deductive inferences can be helpful when it comes to clarifying and structuring this reasoning. As described in the debate on “distributed cognition” and the “extended mind” in cognitive science,⁵³ LAM

49 David J. Godden, "Deductivism as an Interpretive Strategy: A Reply to Groarke's Defense of Reconstructive Deductivism," *Argumentation and Advocacy*, 41, 3 (2005): 168-83, p. 168.

50 Leo Groarke, "In Defense of Deductivism: Replying to Govier," in F. H. van Eemeren, R. Grootendorst, J. A. Blair and C. Willard, *Argumentation Illuminated* (Amsterdam: Sic-Sat, 1992), pp. 113-21, p. 113.

51 Groarke, "Deductivism within Pragma-Dialectics," *Argumentation*, 13, 1 (1999): 1-16, p. 2.

52 Ralph H. Johnson, "Informal Logic and Epistemology," *Anthropology & Philosophy*, 8, 1-2 (2007): 69-88, p. 73.

53 See, for instance, Edwin Hutchins, *Cognition in the Wild* (Cambridge, MA: MIT Press, 1995); Andy Clark and David Chalmers, "The Extended Mind," *Analysis*, 58, 1 (1998): 7-19; Andy Clark, "Curing Cognitive Hiccups: A Defense of the Extended Mind," *Journal of Philosophy*, 104, 4 (Apr, 2007): 163-92; and Michael H.G. Hoffmann, "Learning from People, Things, and Signs," *Studies in Philosophy and Education*, 26, 3 (2007): 185-204.

is supposed to work like a scaffold *for* reasoning, not as a picture *of* it.

Similarly, the evaluative thesis that only deductively valid arguments are “good” arguments has not only been convincingly refuted by many counterexamples which show that we are generally ready to appreciate the quality of non-deductive arguments as well, but again: evaluating the quality of arguments that we find in everyday life is not the task Logical Argument Mapping is supposed to accomplish. Relevant for LAM is only the second definition, the one which Godden discusses as “reconstructive” or “interpretative.” The formulation, however, he provides for this definition is ambivalent. Groarke wrote: “By deductivism I mean the view that natural language arguments should be understood as attempts to formulate deductive arguments.”⁵⁴ Godden in his criticism of this form of deductivism seems to interpret this quote as saying that according to the deductivist view everyone who formulates an argument is driven, at least implicitly, by the objective to provide a deductive argument. This way, Groarke’s definition would be a descriptive claim that raises, as Godden says, “the question whether an argument is *properly* reconstructed as aiming at a deductive standard of evidence.”⁵⁵ However, for Groarke the question is not whether it is *adequate* to represent any natural language argument as a deduction, but whether *we should do it*. His claim is a normative claim, not a descriptive one, so the question is not whether he is right, but whether his suggestion can be justified as *useful*.⁵⁶

Groarke does not only show—as it is well-known—that any argument can easily be transformed into a deductively valid argument by adding a further premise that connects—by means of an appropriate formulation—the other premises with the conclusion, but he justifies his suggestion that we should indeed do so by an argument that is relevant for Logical Argument Mapping as well. His point is that the “unexpressed premises” that we “should” express as the additional premises in deductions are important because they “often expose assumptions which need to be a focus of discussion when we decide

54 Groarke, “Deductivism within Pragma-Dialectics,” p. 2.

55 Godden, “Deductivism as an Interpretive Strategy,” p. 175-176; italics are mine.

56 This is exactly the question Groarke formulates at p. 8 of “Deductivism within Pragma-Dialectics.”

It is surprising that Godden, although he correctly titles his paper “Deductivism as an Interpretive Strategy,” nowhere discusses Groarke’s arguments for this strategy, and whether this strategy is effective for the goals Groarke has in mind.

whether an argument should be accepted.” That is, Groarke’s strategy to model arguments as deductions “can help identify the issues that need to be addressed in dialectical exchange. ... By recognizing these assumptions as unexpressed premises, a deductivist approach furthers the dialectical exchange which is the key to resolving differences of opinion.”⁵⁷

Godden is absolutely right when he says that this way “all argument assessment becomes a matter of determining premise acceptability,” and that the assessment of premise acceptability “is a task for science, not logic.”⁵⁸ But exactly this, I would argue, is the main advantage of “reconstructive” deductionism as a strategy. When it comes to evaluating the quality of deductive arguments, we can clearly separate evaluating the argument’s form and its content.⁵⁹ By “clearly” separating I mean that the evaluation of one of the two should not influence the evaluation of the other. This, by contrast, is not guaranteed with non-deductive arguments. We can expect, for example, that people would reject the form of arguments from analogy, expert opinion, or slippery-slope arguments simply based on the fact that the concrete content of these arguments they are confronted with in a certain situation is unacceptable to them. This should hardly be the case with deductively valid argument forms. In so far as we can evaluate the validity of a deduction by replacing what is claimed in its propositions by variables, it is clear that the evaluation of its form can clearly be distinguished from evaluating its content. Whatever the content may be, it is always possible to argue for the validity of *modus ponens*, *modus tollens*, conditional syllogism, and so on, independently of any specific content. This is not the case for non-deductive arguments.

Even if everything else is contested, logical necessity—and its counterpart, the prin-

57 Groarke, “Deductivism within Pragma-Dialectics,” p. 9.

58 Godden, “Deductivism as an Interpretive Strategy,” p. 174.

59 At this point, I depart from Groarke’s argument for reconstructive deductivism, because he maintains a distinction between “deductive validity and ‘formal validity’” which is hardly convincing. If deductive validity, as he claims, is *not* defined by formal considerations, it can only be determined by considerations that depend on epistemic assumptions regarding the truth or certainty of what is claimed in the premises and conclusion of an argument. This leads to a very strange concept of “deductive validity,” as it becomes visible in his example for a “deductive” argument on p. 11 of his “Deductivism within Pragma-Dialectics.”

ciple of non-contradiction—is something everybody should be ready to accept.⁶⁰ When somebody accepts both the propositions “ p ” and “if p , then q ” as being true but rejects to accept “ q ” as being true, then this person simply excludes herself or himself from the community of people we would consider being worthwhile to argue with in the first place. Demanding the acceptance of the principle of non-contradiction as a precondition for reasonable communication seems to be an idea that is universally shared.⁶¹ That means, deductively valid arguments can provide an Archimedean point stable enough to move things even in conflicts and controversies.

The possibility to clearly separate controversy on an argument’s content from its logical form leads us immediately to the idea that the evaluation of deductive arguments can be simplified by distinguishing two different processes: first, checking whether a given argument is deductively valid, that is whether it follows the logical *form* that is pre-defined, or demonstrable, as valid for a certain argument scheme; and second, the process of reflecting—either individually or in what Pinto called a “critical dialogue”⁶²—on the question whether the *reasons* used in an argument are acceptable. While the first process can be performed more or less mechanically—since this is only about assessing

60 The argument for this normative claim goes back to Aristotle’s justification of the principle of non-contradiction by indirect demonstration (*Metaphysics* IV 4, 1006a15-25: *elenktikôs apodeixai*). While it is impossible to prove the principle directly because doing so would already presuppose the principle itself, we can prove it by shifting the burden of proof to an opponent’s side. As long as such an opponent says anything at all, “he signifies something both for himself and for another... For, if he does not signify something, such a man would not have language and reason (*logos*), neither for himself nor for somebody else. But if any one grants this, demonstration will be possible; for [in signifying something] something is already defined (*estai hōrismenon*, i.e. a boundary is drawn that delineates what belongs to it and what does not).” The point is, such a definition or boundary would be destroyed if someone says “something is x and is not x at the same time.” If there is no longer a boundary between including and excluding a predicate, “then dialog with other people would be annihilated, and indeed with oneself as well; for it is impossible to think if one does not think of one thing” (1006b8-10).

61 See Gregor Paul, “Argumente für die Universalität der Logik,” *Horin - Vergleichende Studien zur japanischen Kultur*, 1 (1994): 57-86, p. 86; and “Logic in Buddhist Text. With Particular Reference to the Zhonglun,” *Horin - Vergleichende Studien zur japanischen Kultur*, 11 (2004): 39-56.

62 Robert C. Pinto, *Argument, Inference and Dialectic. Collected Papers on Informal Logic: Argumentation Library, Vol. 4* (Dordrecht; Boston: Kluwer Academic, 2001), at pp. 123, 131.

whether a given argument meets the requirements of a predefined argument form—the process of reflection leads simply to an open-ended exchange of further arguments that either produces, eventually, agreement or at least a better understanding of the positions at stake.

This distinction between two evaluation processes allows a clear distinction between a logical and an epistemic question. While the former is as simple (or complicated) as the logical system used, the latter has to be decided in a process of argumentation anyway. If any justification of an evidential relation—as we saw with regard to Longino’s triadic epistemology—is mediated by background assumptions whose justification would lead us to further background assumptions, and so on, it is clear that any controversy about the acceptability of premises in an argument can only be decided by further arguments. Epistemic questions are open questions; they are as open as the development of scientific knowledge.

We should keep in mind, however, that the main point in reflective argumentation is neither to create knowledge or justified belief, nor consensus or persuasion, but to stimulate reflection and cognitive change. For this, the only thing we really need is a system of representation whose rules are acceptable across all party lines; rules that allow communication even in cases of deepest disagreement regarding the content of a controversy; a language whose grammar is evident, or can be made plausible, to everyone. This, I believe, can be achieved by reducing the language of argument to its logical core, that is by using only a limited set of deductively valid argument schemes for those arguments that are critical in a controversy. The more we are living in different worlds and playing incommensurable language games, the more we need a language in which at least a core is commonly shared—simply to allow the possibility of communicating about what is not shared.

The possibility to distinguish clearly between an argument’s logical validity and the epistemic question whether its premises are acceptable is my first reason for assuming that the reconstructive deductivism realized in Logical Argument Mapping is a useful and effective strategy to achieve the goals of reflective argumentation. But there are two further reasons.

The second reason for focusing on logical argument schemes is that a system of rep-

resentation that concentrates on these can be much simpler, easier to learn, and therefore more powerful when it comes to both stimulating cognitive change and evaluating one's own argument construction than those systems that try to include every possible form of argument. It is clear that the set of deductively valid argument forms is only a subset of a larger set that includes not only inductive arguments but all sorts of argument schemes that have been studied in informal logic over the last decade.⁶³ However, if the argument that I developed above with regard to diagrammatic reasoning is correct, then it should be more important to provide a limited but powerful system of representation than one that is too complex.

The third reason for using logical argument schemes is that these schemes provide a clear normative standard with regard to the completeness of an argument. To get a deductively valid argument, we do not only need a reason for a claim, but also the guarantee that this reason is sufficient to deduce this claim. In a logical argument, this can be guaranteed by the additional premise already mentioned: it has been called the "major premise" in syllogistic logic, and "inference rule" in other contexts. In LAM, the inference rule is supposed to represent the assumption of a universal law: a law-like relation between reason and claim. In a *modus ponens* argument, for example, we do not only provide a reason *p* for the claim *q*, but also the inference rule "if *p*, then *q*."⁶⁴ It is easy to see that the truth of both the reason and the inference rule guarantee with logical necessity the truth of the claim.

Even though in normal conversation hardly anybody provides complete arguments in this sense, being challenged to do so has two decisive advantages. First, we get access to implicit background assumptions. The reason for this is the following. The fact that somebody provides a certain reason for a certain claim is either based on this person's assumption that this reason is indeed acceptable as a *reason for* this claim or it is not

63 See Footnote 43 and Douglas Walton, *Fundamentals of Critical Argumentation: Critical Reasoning and Argumentation* (Cambridge; New York: Cambridge University Press, 2006).

64 The validity of the *modus ponens* requires, of course, that statements like "if *p*, then *q*," "*p* implies *q*," or "*p* is a sufficient condition for *q*" are defined by the truth table for the material conditional. However, the well-known problems of the material conditional ("if grass is green, then the moon is made of cheese") do not apply here since the second rule requires that an arguer must be willing to defend the truth or acceptability of those statements as general rules.

based on this assumption. Since we would not provide a certain reason without assuming that this reason is indeed acceptable as a reason for a certain claim, the latter can be excluded. This means, if someone provides p as a reason for q , and if the structure of the argument this person has in mind can be represented in *modus ponens* form, then we can assume that an inference rule like “if p , then q ” is part of this person’s background assumptions.⁶⁵ And this again means that visualizing this background assumption in form of an inference rule is the first step to getting access to it.

It is important to note that the point here is not whether someone really believes that “if p , then q ” is true, or has at least some awareness of such a proposition.⁶⁶ Mapping a *modus ponens* argument in LAM is not supposed to represent someone’s reasoning adequately, as already mentioned. The crucial point is solely that such a representation stimulates our reflection on the acceptability of what is visualized. Even if it turns out that the universal rule “if p , then q ” is false, or even if someone would not accept the strong inference rule “if p , then q ” in case she provides p as a reason for q , but might prefer something weaker like “if p , then probably q ,” it still makes sense from a strategic and heuristic point of view to challenge this person to formulate her argument in the stronger, deductive form. Again, the objective is to stimulate reflection, to direct attention to possible background assumptions, and to motivate the development of further arguments, objections, refinements of formulations, or at least the recognition of open questions and problems.

This leads directly to the second advantage of being challenged to construct logically complete arguments. As already indicated by Groarke: if we are visualizing an argument completely, everything is on the table that can be attacked and must be defended by further arguments in case of doubt or controversy. An argument whose conclusion is necessarily true if all the premises are true can only be weakened or defeated by attacking one of its premises. This means that mapping arguments in deductive form inevitably

65 Groarke in “Deductivism within Pragma-Dialectics” provided a similar argument: the speech acts “argument” and “assertion” imply that the performer of these speech acts commits herself to the belief that her conclusion is true if her premises are true (pp. 6-7).

66 This counters Godden’s first criticism of the Groarke’s argument that is mentioned in the previous note; see Godden, “Deductivism as an Interpretive Strategy,” p. 178. His second argument against Groarke is refuted by what follows.

guides our reflection in a certain direction. Since any logically complete argument can be attacked by two strategies—either by criticizing the evidence or the inferential relation between evidence and claim—it is clear that we need to be ready to defend always two things independently of each other: on the one hand the truth of the reasons provided and, on the other, the truth of the inference rule that would legitimate using something as reason for something else. This way, Logical Argument Mapping is expected to guide the user in a step-by-step process that should reveal, eventually, the inferential structure of an entire web of beliefs—as far as it is relevant for a certain position in a certain situation.

To summarize, the normative standard of logical validity as it is formulated in the three rules of Logical Argument Mapping should be sufficient to meet the five requirements necessary for reflective argumentation that I listed above. The limited list of clearly defined argument schemes mentioned in the first rule allows us to evaluate the completeness of arguments (i.e., to check whether all the elements that are required for a certain argument scheme are formulated), and the second rule challenges us to assess the acceptability of all their premises (R5*). At the same time, since the rules and the argument schemes of LAM form a clearly defined, normative standard of how to present arguments, the method challenges us in a way that resistance against cognitive change can be overcome (R3*).

Since the validity of these argument schemes is either evident or can be demonstrated independently from any specific content, the LAM rules should be acceptable for everyone independently of his or her specific stance in a controversy. This means, a controversy can be about the content of an argumentation, not about how to construct logically valid arguments (R4).

Finally, the challenge to construct complete arguments will lead, first, to a representation of important elements of an arguer's implicit background assumptions as they become visible in an argument's inference rule; secondly, it will guide the process of argument visualization step by step (R2). Visualizing background assumptions provides access to them. And getting access to those implicit patterns of thinking is a precondition to reflect critically on them, to criticize or defend them by further arguments, and, thus, to explore entire “webs” of mutually supporting beliefs in an ongoing process. Nothing

that is relevant for a certain argument remains hidden if logical completeness is required. This opens up those belief-value-attitude systems that are crucial for sensemaking and framing (R1).

The main point is that LAM's normative standard challenges the user, first, to break down complex considerations or vague ideas into a clearly structured network of mutually supporting arguments and, second, to reflect on the acceptability of the premises and implicit background assumptions that become visible this way. As long as we separate logical and epistemic processes of argument construction and evaluation, we can delegate all the questions that divide us in controversies to an open-ended process of reflection and argument construction while, at the same time, getting a communication tool whose reasonableness can be accepted independently of all partisanship.

V. AN EXEMPLARY PROCESS OF ARGUMENT MAPPING

To provide an example of how LAM can be used as a method of reflective argumentation, let me map an argument that has been discussed in the public policy literature in a debate on limitations of Toulmin's model of argument.⁶⁷ Using the conventions defined in the key on top of the map, the original argument can be represented as in Figure 3.

The original Toulmin-style visualization formulated the following as the argument's

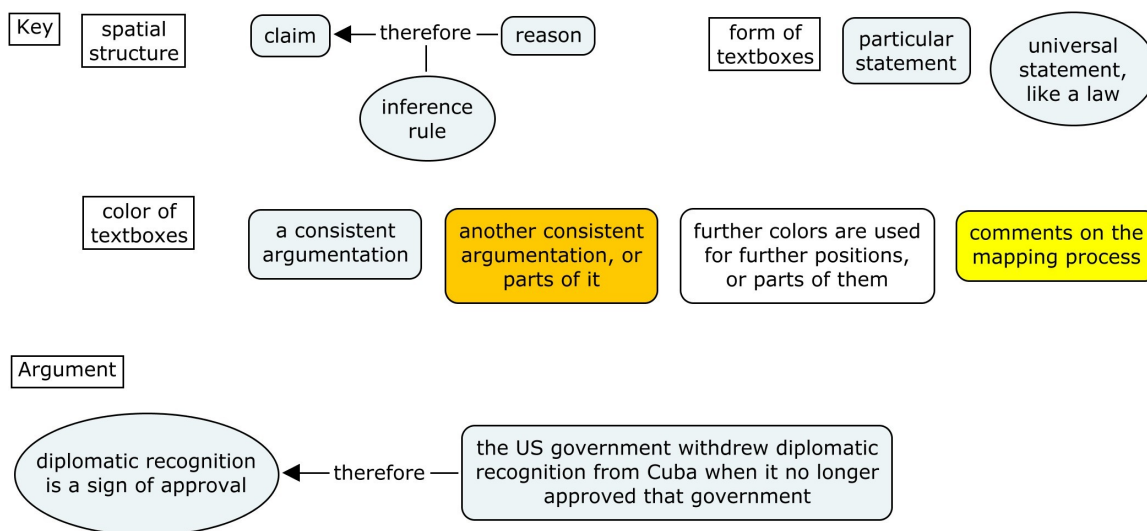


Figure 3: A universal statement as a claim (left), and a particular as reason (right)

“warrant”: “*And since* US actions with respect to Cuba are representative of foreign policy decisions in general ...” While according to Toulmin’s approach the exact function of what he calls “warrant” is not specified—besides the general requirement that the warrant has to “authorize” the step from the reason to the claim—in LAM we have to decide according to which argument scheme the argument should be constructed. This again determines the exact wording of the “warrant”—or the “inference rule,” in my terminology. Looking at the list of logical argument schemes that are defined in LAM⁶⁸—and based on the intention of the original argument as it becomes visible in its warrant—we can see that the argument can be formulated as “complete induction”⁶⁹ (Figure 4, blue part).

If we look at the inference rule (in the middle) that we are forced to use in order to reconstruct the argument as complete induction, the advantage of permitting only logically valid argument schemes becomes obvious: This strong requirement stimulates our reflection on the question whether this inference rule can really be accepted. Since any universal statement can be refuted by only one counterexample, it becomes immediately clear—based on the objections on the right—that this inference rule is unacceptable. We are challenged, thus, to reconsider the whole issue more carefully.

Looking at the case of the Soviet Union, for example, could thus lead to what Peirce called a “theoric shift,” a change of perspective, that can be summarized then under the concept “diplomatic efficiency” (a “hypostatic abstraction” that is new to the original argument).⁷⁰ This opens up the possibility to revise the whole argumentation. Although representing those “revision schemes” in the map itself is not necessary, visualizing these

68 See <http://www.prism.gatech.edu/~mh327/LAM/>.

69 Complete induction—also called “mathematical” or “recursive induction” in the axiomatization of arithmetic—is a deductively valid argument form. See [link to the author’s webpage], and William Kneale and Martha Kneale, *The Development of Logic* (Oxford: Clarendon Pr., 1988 <1962>), p. 467-77. To enlarge the set of deductive argument schemes that are available in LAM, some non-deductive argument forms (induction; arguments from authority and analogy) have been transformed into logically valid forms.

70 See Hoffmann, “Seeing problem,” and “Signs as Means for Discoveries. Peirce and His Concepts of ‘Diagrammatic Reasoning,’ ‘Theorematic Deduction,’ ‘Hypostatic Abstraction,’ and ‘Theoric Transformation,’” in Michael H.G. Hoffmann, Johannes Lenhard and Falk Seeger, *Activity and Sign – Grounding Mathematics Education* (New York: Springer, 2005), pp. 45-56.

reflective steps can stimulate our reasoning on the whole issue. One could think, for instance, that the initial focus on a general claim like “diplomatic recognition is a sign of approval” does not make much sense. Why not, instead, focus on a concrete problem like the question whether the US should recognize Iran? This way, a quite substantial revision of our thinking could be possible (Figure 5); a revision that leads again to new questions. But this is exactly what reflective argumentation is supposed to do.

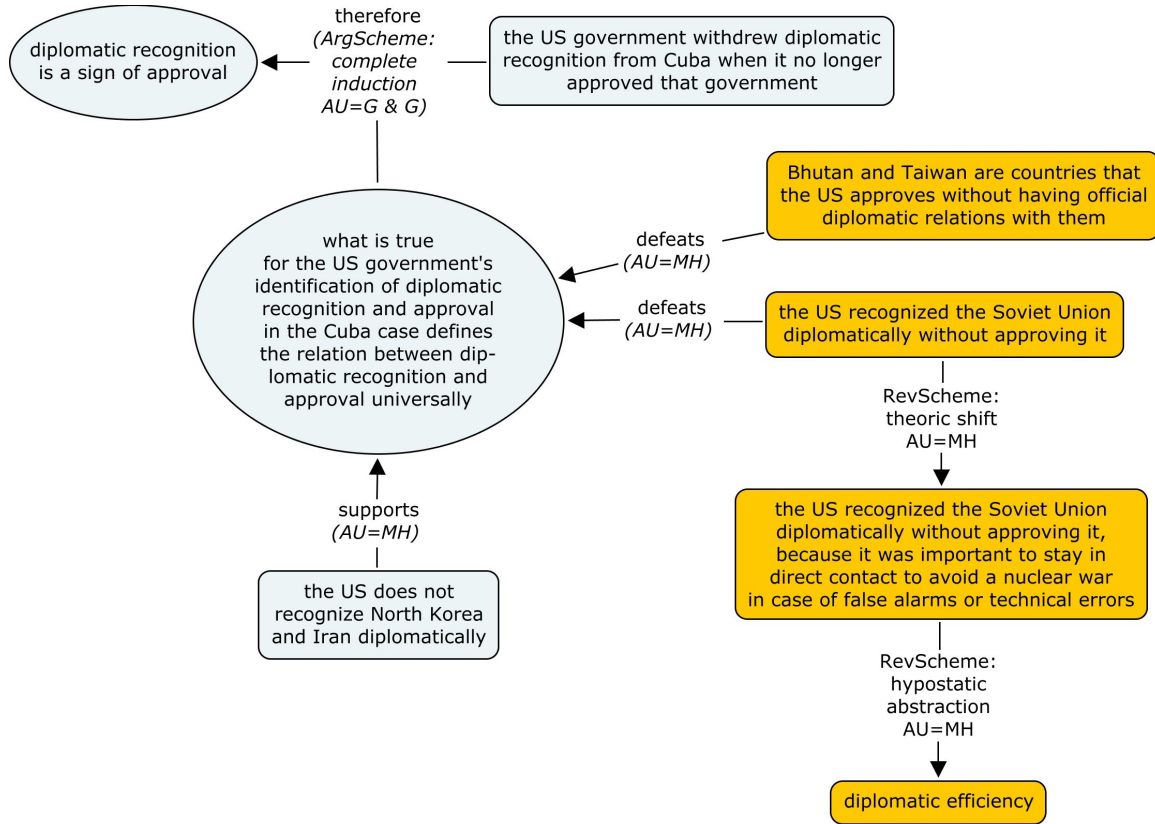


Figure 4: In blue the original argument with a supporting consideration, and in red some objections and further reflections. “AU” refers to the author of an argument. In this case, the universal statement that forms the main argument’s inference rule can easily be defeated by two counterexamples. “RevScheme” refers to “argument revision scheme,” that is a scheme according to which arguments can be revised in LAM. “Theoric shift” means a change of perspective; “hypostatic abstraction” is the creation of a new concept for a new idea.

VI. CONCLUSION

Tim van Gelder once remarked that trying to represent arguments only in deductive

forms would be like “trying to fit a left foot into a right shoe.”⁷¹ This is indeed exactly what should happen in Logical Argument Mapping. The crucial difference is, however,

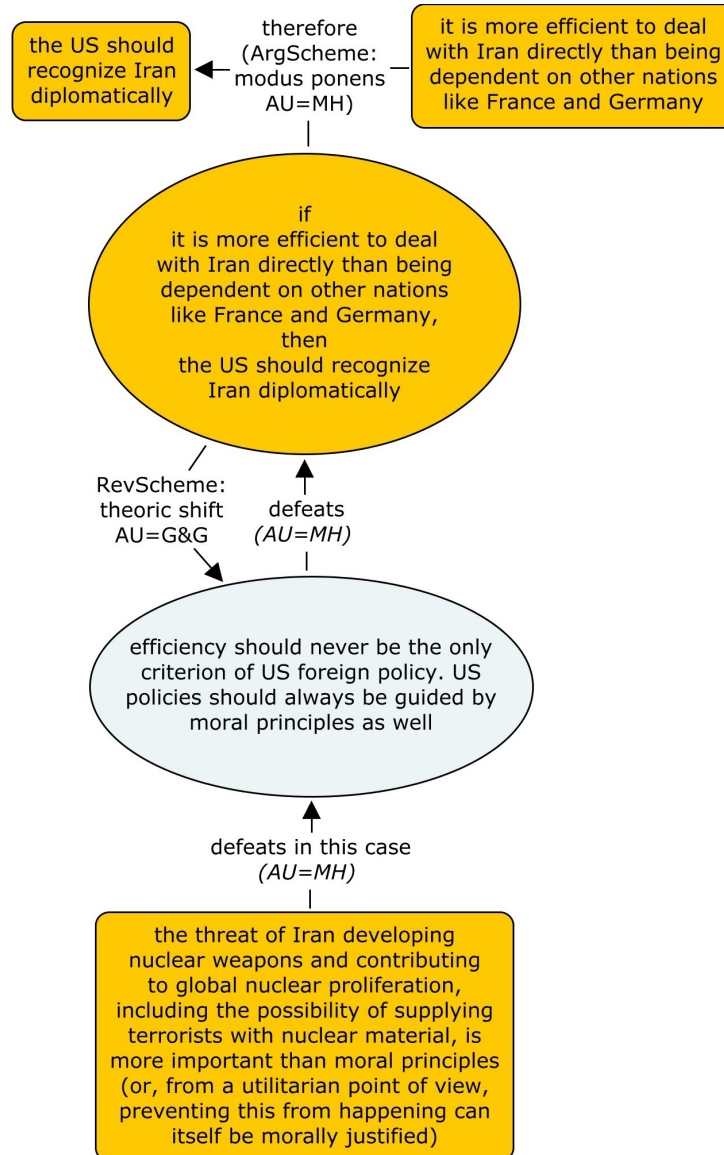


Figure 5: A complete revision of the original argument that leads to a new differentiation of the problem

that I hope that our habits of thinking show some more ‘plasticity’ than our feet, and that they can adapt to a framework that should work more like a scaffold than a corset. The point of my argument is not that we design argument visualization tools that fit nicely to the paths we are thinking in anyway, but tools that affect and guide our reason-

⁷¹ Personal communication.

ing. If the goal is reflective argumentation—that is, to stimulate reflection on one’s own thinking by constructing and evaluating arguments—then, as I tried to argue in this paper, we need a representational system to visualize arguments that is challenging and powerful enough to motivate cognitive change and learning; a normative standard of argument construction and evaluation that forces us to be more precise and more reflective regarding implicit background assumptions than we might wish to be; a standard that helps us to clarify our thinking, and to identify weak points and unknowns; a visual language that motivates reflection so that we can overcome the limitations and simplifications of habitualized ways of thinking; a normative standard of argument visualization that should be universally acceptable⁷² so that it can provide a communication and reflection tool even for situations where everything else is contested.

My goal was to show that a representational system like Logical Argument Mapping can have the power to affect our thinking and to stimulate cognitive change. Being challenged to construct arguments that are logically complete will at least force us to explicate all those assumptions that might otherwise hinder cognitive change and learning. Only what is visibly on the table motivates reflection, criticism, and support by further arguments.

⁷² This does not mean “eternal.” The normativity of representation systems does not exclude their evolution; see for instance the development from Euclidean to non-Euclidean axiomatizations of geometry.